DOCUMENT RESUME

ED 211 334 SE 035 944

AUTHOR Collins, John T.; Sarrubbo, John N.
TITLE Assessment of Science Requirements for Technical and Engineering Programs at Westchester Community College, Valhalla, New York. Final Technical Report.
INSTITUTION Westchester Community Coll., Valhalla, N.Y.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE 78
GRANT NSF-SED-78-09671
NOTE 63p.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *College Science; College Students; Community Colleges; *Engineering Technology; Postsecondary Education; *Program Evaluation; Surveys; *Technical Education; *Undergraduate Study
IDENTIFIERS *Science Education Research

ABSTRACT

Experience at Westchester Community College has indicated that a significant percentage of students enrolled in the Engineering Technologies program, and almost all of those enrolled in the Engineering Science program, transferred to four-year institutions. Course work in higher level mathematics, as well as inorganic chemistry and modern physics, was needed by students who transferred. In order to develop a program to meet the overall needs of these students, an inventory of student trends was necessary. The inventory included three activities. A survey was conducted of second-year students currently enrolled in the Engineering Science and Engineering Technology programs. This survey yielded a base line, established the existing goals and areas of interest of the current student population. A survey of graduates of the Engineering Technology and Engineering Science programs from 1973 through 1978 was conducted to determine past trends with respect to each of these programs. This survey was compared with the survey of current students in order to determine the reliability of the survey and the significant variations between current and past students. A survey of the four-year engineering technical colleges which accept most of the graduates from Westchester Community College's programs was conducted. It provided information indicative of the overall preparedness and success of Westchester Community College students at these institutions. Results of these surveys are presented and discussed. (Author/RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED211334

ASSESSMENT OF SCIENCE REQUIREMENTS FOR TECHNICAL AND ENGINEERING PROGRAMS AT WESTCHESTER COMMUNITY COLLEGE VALHALLA, NEW YORK

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

National Science Fdn.
Dir. for Science Ed./
SEDR

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Prepared for:

National Science Foundation
Division of Science Education
Development and Research
Washington, D.C. 20055

Prepared by:

Professor John T. Collins
Professor John N. Sarrubbo

SE035 944

TABLE OF CONTENTS

Page

Summary

Section A

A Historical Perspective and Background 1, 2

Section B

B-1 Program Requirements - Present 3
B-2 Student Needs 4, 5
B-3 Enrollments Past, Present and Future 5, 6
Table No. 1 - 2nd Year Enrollments/ Graduates 1973-78 6
B-4 Program Update 7, 8
B-5 Program Evaluation Survey 8, 9

Section C

C-1 Current Student Survey 10
C-2 Why Westchester Community College 11
C-3 Transfer/Occupation 11, 12
Table No. 2 - Transferring Students 12
C-4 Deficiencies 13

Section D

D-1 Graduate Survey 14
Table No. 3 - Summary of Respondents by Year 14
Table No. 4 - Respondents by Curriculum 15
D-2 Why Westchester Community College 15
D-3 Transfer/Occupation 16, 17
Table No. 5 - Respondents Transferring to 4-year College 18
D-4 Transfer Credits Accepted 18, 19
D-5 Strengths and Weaknesses of the Program 19

Section E

College Survey 20, 21

Page

Section F

F-1 Survey Conclusions 22, 23, 24
F-2 Problem Identified 24, 25
F-3 Resolution of Problems 25, 26, 27, 28
F-4 Method of Implementation 28

Appendices

Appendix A, pg. 1 Engineering Science Logical Sequence of Program
" " pg. 2 Civil Technology Logical Sequence of Program
" " pg. 3 Electrical Technology Logical Sequence of Program
" " pg. 4 Mechanical Technology Logical Sequence of Program

Appendix B, Current Student Survey (Questionnaire)

Appendix C, Post Graduate Survey (Questionnaire)

Appendix D, Transfer Survey

Appendix E, Post Graduate Survey

Appendix F, pg. 1, 2 Current Student Survey - Electrical Technology
" " pg. 3 " " " - Civil Technology
" " pg. 4 " " " - Mechanical Technology
" " pg. 5 " " " - Engineering Science

SUMMARY

Westchester Community College is a comprehensive community college providing 26 associate degree programs in technical and general education for full-time, part-time and continuing education students. The college is a component of the State University of New York, locally sponsored by Westchester County. Of particular interest for this need study were the enrollments for Fall 1977 in the Engineering Science and Engineering Technologies. The full time enrollment for the Engineering Science was 97 students with some 30 attending on a part-time basis. The Engineering Technologies combined total of some 378 full time students, with some 242 in attendance on a part-time basis.

Prior experience had indicated that a significant percentage of those enrolled in the Engineering Technologies transferred to four-year institutions with almost all of those enrolled in the Engineering Science Program transferring.

The NSF Grant provided the vehicle by which these prior indications were documented as well as the documentation of the needs of the students enrolled in Engineering Science Program and the Engineering Technologies.

As part of the study a detailed survey was undertaken to establish the actual percentages of those transferring to four-year schools and the difficulties associated with those transferring. This survey was taken of three groups, i.e., current enrolled students, past graduates of the college and the Engineering Schools to which a predominant portion of the graduates transferred to.

The results of the survey indicated:

1. That all of the students enrolled in the Engineering Science program transfer to a four year institution, with approximately 50% of those enrolled in the Technical program transferring to four year schools (predominantly full Engineering as opposed to Engineering Technology).

2. That of those transferring to four year schools from the Technical Program, approximately 35% remain to take additional course work at Westchester Community College. This course work is normally in the area of higher level mathematics as well as Inorganic Chemistry and Modern Physics.

3. Students continuing at Westchester Community College, do so to meet the requirement of four year schools. This requirement forces many of the students to be "out-of-sequence", thus delaying their entry to a four year school by at least six months and in most instances one year.

4. "Out-of-sequence" is primarily caused by a deficiency in mathematics and not physics or chemistry.

In response to the survey results modification of the existing programs are recommended. These include: a) development and implementation of two new math courses, Technical Math I and Technical Math 2 with calculus which will prepare students enrolled in the Technical Programs for Calculus II. b) further study and development of a computer science option for the Engineering Science program. c) Further study of free Technical electives in the Engineering Science Program.

SECTION A

A. Historical Perspective and Background

Westchester Community College (WCC) opened in 1946 as the New York State Institute of Applied Arts & Sciences in White Plains under the auspices of the New York State Education Department. In 1948, an evening division program for adults was implemented. In 1953, sponsorship of the College shifted from the State Education Department to Westchester County and the institution was renamed Westchester Community College. By 1961, the College moved its physical location to the 218 acre Valhalla Campus where we are now housed.

The programs offered, by the Technical Division of Westchester Community College were occupationally oriented. These programs prepared students to enter the job market with technical skills. Students completing the technical programs in Chemical, Civil, Electrical or Mechanical Technology received the Associate of Applied Science Degree (A.A.S.).

About 1959, the need arose for a parallel Engineering Science Program. This program prepares students to transfer to four year engineering schools, with a minimum of loss in transfer credit. Students graduating from the Engineering Science Program receive an Associate of Science Degree (A.S.).

By 1971, there existed two college structures: a day division for full-time undergraduates and after 5 P.M. an evening division to

provide programs and courses comparable to those offered in the day division and to make available subjects at a college level for those who wished to gain additional technical skills, scientific knowledge and general information to prepare them for more responsible positions and to increase their occupational versatility and competency. In 1971 a major organizational change occured. The day and evening divisions were merged into the one-college concept.

For the purposes of our study we are looking at occupational and transfer programs, in the Math, Science and Engineering Technology Division of the college.

SECTION B

B-1. Program Requirements - Present

Current requirements for the Engineering Technologies Programs are shown in Appendix "A". Inspection of these requirements indicates that all the Technologies have a common core for the first year with concentration in the second semester of the second year. This core consists of the following:

English	6 credits
Social Science	6 credits
Physics	8 credits
Math	4 credits
Engineering Drawing	2 credits
Physical Education	2 credits
	28 credits

The Engineering Science Program (Appendix A) is a highly structured transfer program, equivalent to the first two years of a four year engineering school and is oriented towards direct transfer to the junior year of a four year engineering school with minimal loss in academic credits. The course work in this program has a heavier emphasis on the mathematics and sciences, i.e., physics and chemistry.

The Technical Programs are occupationally oriented with emphasis on job related courses to provide for a direct entry into the labor force upon graduation from Westchester Community College.

B-2. Student Needs

A reoccurring problem within each of the Technical Programs is the change in goals of the students enrolled in that program. Past history has indicated that students choose the various technical curriculum based upon many factors, i.e.:

a. High School background,

b. Uncertainty of field of interest,

c. Development of job related skills for direct entry into the labor force,

d. Parental and peer pressure.

Regardless of their entry goals, many students experience a change in career goals as they continue in the program. The most significant change (approximately 50% of the students enrolled), is the change in emphasis from an occupationally oriented program to that which will allow them to transfer to a four-year college for a Baccalaureate Degree in Engineering or Engineering Technology. These changes in goals require students to take additional math courses to enable them to transfer to a four-year school. To satisfy needs of those students who elect to transfer to four-year colleges, each of the three technical programs have allowed for the substitution of specific math courses in place of certain technical electives. Inspection of each of the three Technical Programs (Appendix "A") indicate the specific technical electives that may be replaced with a math substitute. Thus, each technical program has adopted a flexible format to provide a satisfactory balance between the goals of its program (occupational) and the students' needs (occupational and/or transfer).

Although this flexibility has been maintained within each of the Technical Programs, a reoccurring problem is the ability of students to transfer to a four-year college upon graduation from WCC. This is primarily due to the fact that they do not have a suitable mathematics background (at least Calculus II) to permit them to take higher level courses at the college of interest. Thus, the student is normally required to make up these deficiencies either at WCC or the four-year college.

While it can be argued that make-up for a deficiency is required because of the students incorrect choice of program, i.e., he could have chosen engineering science, it is incumbent upon each program to prove its students the greatest flexibility of choice without diminishing the integrity of the program.

It should be noted that a significant percentage of Technical students transfer from the technical program to the Engineering Science program. Since this is "intra college" it has been excluded from this study. Further studies are thus required to investigate this change of program within the College.

B-3. Enrollments Past, Present and Future

Prior to adopting a modification to existing programs, it is essential that the College evaluate the number of students enrolled in each program, based upon past experience as well as future predictions. This is especially true in light of the overall decrease in the general population of the college age group as well as economic constraints.

The enrollments in the technical program at Westchester Community College has remained relatively constant since 1973, with the enrollment reflecting the cyclical nature of the engineering profession as do engineering enrollments at other institutions. Table No. 1 lists the enrollment and number of graduates in the years 1973 through 1978. Inspection of Table No. 1 indicates a downturn in enrollment during the mid-seventies due to the previous economic recession with a subsequent increase in the late seventies. It is anticipated that these enrollments will not significantly change in the foreseeable future and it is anticipated that they will basically parallel the national trend of both two and four year technical schools.

TABLE NO. 1

2nd Year Enrollments/Graduates 1973-1978
(Full-time and Part-time Students)

Year	2nd Year Enrollments	Graduates				
		Eng Science	Civil Tech	Elec Tech	Mech Tech	Total
1973*	166	13	38	63	19	135
1974	121	13	37	64	20	134
1975	118	13	29	48	13	103
1976	123	8	33	50	7	98
1977	160	16	45	60	17	138
1978**	159	21	40	57	21	139

* Includes late graduates from 1972.

** Does not include December graduates.

Table No. 1 also indicates that past and current enrollment figures are sufficient to support the existing programs. However close inspection indicates that they are not large enough to support a dualization within each of the technologies, i.e., transfer orientation plus occupational orientation. To do so would be contrary to sound academic development in that:

a. By itself it would not significantly increase the number of students enrolled in the technical program since the change in student goals occurs after enrollment in a program.

b. It would have the negative effect of reducing the options available by the reduction of class size below limits presently considered economically and academically sound.

c. It would not offer the flexibility intended since it would force students to make a choice early in the program.

d. If adopted, it may not attract those students for which it was intended since students typically choose the Technical program for the occupational education offered then desire to transfer.

Based upon the above, it is obvious that dualizing the technical program is not a viable alternate in satisfying the needs of past, present and future student population.

B-4. Program Update

Although each of the technical programs have modified their program to satisfy the change in career goal of their students, each of these changes have been undertaken on a department by department basis. Recent development at the College now offer this opportunity to examine all Technical programs as they relate to the overall

"common core" of the college. These programs are:

a. Evaluation of all programs at the College to determine its students needs as well as the success of that program in meeting these needs.

b. The development of a general core for the math, sciences and social sciences/humanities for the entire College.

c. The development of a common core within the Engineering Technology to satisfy the general College requirement as well as the needs of its students.

d. This grant will develop a model for the evaluation process that will be used by others to determine the success of their program.

B-5. Program Evaluation Survey

In order to develop a porgram that will meet the overall needs of students enrolled in the technical areas, it is essential that an adequate inventory of student trends be developed to delineate these needs. In order to fully evaluate the future needs, a suitable inventory of past and current students was compiled.

The data collection inventory was addressed in three distinct categories as follows:

1. A survey of second year students currently enrolled in the Engineering Science and Engineering Technology at the College was conducted. This survey yielded a 100% base line, establishing the existing goals and area of interests of current student population.

2. A survey of graduates of the Engineering Technology and Engineering Science program from 1973 through 1978 was conducted to determine the past trends with respect to each of these programs. This survey was compared with the survey of current students in order to determine the reliability of the survey and the significant variations between current and past students.
3. The survey of the four-year Engineering Technical Colleges which accept most of the graduates of Westchester Community College transferring from the Engineering Science and Engineering Technology curricula. This survey also supplied information indicative of the overall preparedness and success of WCC students at these institutions.

The results of these surveys are discussed in Sections C, D and E of this study.

SECTION C

C-1. Current Student Survey

The Current Student Survey attached in Appendix "B" was given to some 100 (out of approximately 120) second year students of the Engineering Technology and Engineering Science curricula. The survey consisted of six short answer questions which included the reason of choosing Westchester Community College, highest level math course taken as part of the program and whether or not the student anticipated transferring to a four-year school.

Of the 100 students surveyed, the following is the breakdown by program:

Program	No. of Second Year Students
Engineering Science	18
Civil Technology	25
Electrical Technology	48
Mechanical Technology	9
	100

Subsequent sections indicate the results of the survey taken of the current student population. Where applicable the survey has been summarized by pure transfer oriented programs (engineering science) and those that are occupationally oriented, i.e., the Engineering Technologies.

C-2. Why Westchester Community College

The initial question of the survey requested the reason for choosing Westchester Community College. The survey allowed for more than one response. The compilation of the responses indicated that more than 50% of the students surveyed chose the Community College based upon the programs. This indicates that the present programs are attracting students interested in engineering and engineering technology.

C-3. Transfer/Occupation

The remaining questions were analyzed with respect to the specific program to determine the needs of students in each of those programs, as well as the deficiencies in each of those areas. Those questions included in the survey dealt with:

a. The highest level of math courses taken at WCC as part of the program.

b. The student's intent to take additional math courses at WCC subsequent to degree.

c. Whether or not the student intended to transfer to a four-year college.

d. If transferring, what school and on what basis.

As would be expected, all the Engineering Science students indicated that they intended to transfer to a four-year college and had completed a mathematics requirement through Differential Equations. Of the other three curricula, Table No. 2 indicates the number of responses transferring to a four-year institution, as well as the number taking a higher level of mathematics courses (Calculus 1 or

higher) as part of the degree requirements.

TABLE NO. 2

Curriculum	No. of Students Transferring Full Time	Part Time	No. Electing Higher Level Math*
Engineering Science	18	-	18
Civil Technology	17	4	13
Electrical Technology	19	10	16
Mechanical Technology	4	2	4

*Calculus I or higher

Inspection of this Table indicates that approximately 70% of the students enrolled in the three Engineering Technologies surveyed intended to transfer to four-year institutions. This percentage is relatively high, and while although not truly representative of those who will ultimately transfer, it does indicate the desire of students enrolled in the programs to continue their education at four-year schools.

This conclusion is reinforced in that the 82 students enrolled in the three Technical programs have taken or are taking mathematics courses above those required in their program. This tends to support the high number of students enrolled in the Technical program desiring to transfer to four-year colleges.

C-4. Deficiencies

Although not part of the survey, additional follow-up indicated that current students were having difficulty transferring to a four-year school since they had not completed Calculus 2. Further questioning of the students indicated that they had decided at a relatively late date to transfer to these four-year schools and were unable to take the proper sequencing of courses that would enable them to complete the mathematics requirement. Thus most students were intending to stay at the Community College to take additional mathematics courses to qualify them for admission to a four-year school. They indicated that each of the Engineering Technology Curricula should be modified so as to insure that students desiring to transfer would have the flexibility of obtaining the minimum requirement prior to transfer.

This transfer requirement was borne out by a subsequent survey to the colleges. That survey indicated that most of the colleges (to which the technical students transfer) require at least Calculus 2 as a minimum prior to allowing the student into their program.

SECTION D

D-1. Graduate Survey

The Graduate Survey attached in Appendix "B" was mailed to some 800 graduates of the Engineering Technology and Engineering Science programs for the years 1973 through 1978. This survey was similar in nature to the survey used for the current student population with appropriate modification. This survey consisted of 10 short-answer questions with additional space provided for three essay type questions. It is significant to note that majority of the respondents took the time and effort in responding to the essay questions. This indicated that those responding were interested in the survey and did their best to provide information that would be of genuine interest and use to each program for subsequent program modification.

Of the 800 surveys mailed, some 100 were returned completed, or 12% of the total survey population. The return percentage was considered satisfactory in light of the type of survey conducted. In addition, the responses (reference Table No. 3) were reasonably distributed for each of the graduation class.

TABLE NO. 3

Summary of Respondents by Year

Year	Surveyed	Respondents	% Response
73	166	14	8.0
74	121	9	7.4
75	118	18	15.2
76	123	16	13.0
77	[illegible]0	23	14.4
78	115	18	15.6
Total	803	98	12.2

In addition, a cross check was made to determine the respondents within each of the programs of the study to determine the reliability of that response in view of the total number of graduates. Table No. 4 indicates the respondents by curricula of the overall survey.

TABLE NO. 4

Respondents by Curriculum

Curriculum	Total Surveyed	Respondents	% Responded
Civil	234	35	15.
Electrical	325	28	8.6
Mechanical	96	6	6.2
Engrg. Science	101	20	19.8
Other	47	6	12.8

For a survey of this type, a significant response is based not only on the percent response but also the total number of respondents in each category. Based upon the above Table, the returns were considered acceptable with the exception of the Mechanical Technology which showed a low percentage return with only 6 out of some 96 graduates responding to this survey. For this reason, the Mechanical Technology was excluded from the detailed analysis subsequently conducted for the other three curricula. However, since all the technical programs have the same core, it is safe to assume that the findings of this study would also be applicable to the Mechanical Technology.

D-2. Why Westchester Community College

The initial question of the graduate survey requested the reason for choosing Westchester Community College. This survey allowed for

more than one response to the question. The compilation of these responses are shown below.

Reasons for Choosing WCC	Percent
Programs offered	60%
Local College	70%
Financial Considerations	63%
Other	12%

These percentages are in reasonable agreement to the percentages found in the "Current Student Survey". It should be noted that even though these students have not been in attendance at the College for a number of years, they still indicated that their initial choice of WCC was based on the types of programs offered as well as financial considerations.

D-3. Transfer/Occupation

The remaining questions were analyzed with respect to the specific programs to determine the significant deficiencies which exist with each of the existing programs. The survey questions dealt with:

a. The number of respondents transferring to four-year colleges.
b. The highest level math courses taken as part of the program.
c. The highest level math courses taken at WCC.
d. Specific comments with respect to the strength and weaknesses of the Engineering Science and Engineering Technology Curricula.

It should be noted that due to the limited number of respondents in certain areas, i.e., Mechanical Technology, subsequent analysis was based only upon the Engineering Science and the Civil and Electrical Technologies programs.

As would be expected, all the Engineering Science graduates transferred to a four-year institution after completing the program requirements. Table No. 5 indicates the number of Civil and Electrical graduates transferring to four-year institutions by year of graduation. Inspection of this Table indicates that approximately 50% of the graduates in each program attended a four-year institution upon graduation from WCC.

In addition, the survey indicated that some 60% of the students graduating from Electrical or Civil programs took additional math courses at WCC, above those required in their program, with some 35% remaining after graduation to take additional mathematics course.

These percentages agree quite favorably with the percentage of the current students taking higher level mathematics courses. The 35% figures confirms the "out-of-sequence" deficiency that currently exists within the program.

TABLE NO. 5

Respondents Transferring to 4-year College

Year	Program	Total Number of Respondents	Respondent Transferring
1973	Civil	6	4
	Electrical	3	2
1974	Civil	4	3
	Electrical	3	2
1975	Civil	6	6
	Electrical	3	4
1976	Civil	8	8
	Electrical	5	3
1977	Civil	7	4
	Electrical	4	1
1978	Civil	4	3
	Electrical	5	2

D-4. Transfer Credits Accepted

Of those students transferring to four-year schools, 58 pursued a Baccalaureate degree in engineering, 5 pursued a Baccalaureate degree in engineering technology and 3 a four-year business related degree.

Although dependent upon the transfer college chosen the Engineering Science students faired slightly better on transfer to four-year schools with an average transfer of some 66 credits. Civil and Electrical Technology students received between 55 and 65 credits

on transferring with an average of some 60 credits. Although some of these transfer credits may be for work completed at the College after graduation (Calculus 3, Calculus 2, etc.) it does indicate a high degree of acceptance by four year institutions of the credits taken at the Community College.

D-5. Strengths and Weaknesses of the Program

Although subjective in nature, the essay responses gave additional insight into the overall success of the Engineering Science and Engineering Technology programs in meeting the needs of its students. Classified into broad general categories, the respondents indicated:

1. All the programs offered at the College were technically sound, with Engineering Science more transfer oriented.
2. That additional mathematics courses should be included within the technical programs, not only to provide a better sequence for those transferring to other schools, but also to provide those students that are occupationally oriented a greater background in mathematics.
3. Certain laboratories, especially in electronics and physics, should be updated with more modern equipment indicative of recent developments in electronics.

SECTION E

College Survey

A survey was sent to the Dean of the 26 colleges listed in Appendix "D" to which our students transfer. Of these 26 colleges, some 13 responded to the questionnaire. Of those responding, all indicated they accepted direct transfer from the Engineering Science program with some 80% accepting transfers from the Technology Curricula.

However, many of these schools have found the graduates of the technology programs deficient in mathematics. Based upon their past experience, a number of these schools are insisting that students transferring from the technical curricula have at least Calculus 2. This decision is based on their experience with a student who enters their program without Calculus 2 does not have the minimum mathematics requirements that are prerequisites of their technical subjects. This requirement in many instances requires the technical student to remain at Westchester Community College to complete this requirement prior to transfer, thus delaying his entry into the four-year school for at least six months and in many instances for a full year.

In the area of physics and chemistry the colleges surveyed were less emphatic. Most accept the Technical Physics I and II taken by students enrolled in the technical programs but do require in many cases that transferring students take Modern physics (either at Westchester Community College or their institution). The same holds true for the normal chemistry requirement.

Although all the colleges surveyed accept direct transfer from the Engineering Science Program a follow up did indicate that the physics sequence and elective (options) offered in this program be further studied to maximize the transfer potential of the program. Of special note were:

a. reduction of the physics requirement by one term.
b. introduction of thermo dynamics and electrical engineering into the program.
c. introduction of a computer science option.

Each of these should be studied. However, since they do not significantly affect transfer opportunities (as does the math requirements) and do not have a common denominator they must be treated on an individual basis apart from this study.

SECTION F

F-1. Survey Conclusions

Based upon the results of the surveys (both current and graduate), as well as the anticipated trends in future enrollment, the following conclusions are offered with respect to the Engineering Science and Technical Programs that are offered at Westchester Community College. These are as follows:

a. The survey indicated that the Engineering Programs, Technical and Engineering Science, offered at the Community College are of high quality and basically satisfy the need of students entering each of the programs.

b. That all of the students enrolled in the Engineering Science program transfer to a four-year institution, with approximately 50% of those enrolled in the Technical program transferring to four-year schools (predominantly full Engineering as opposed to Engineering Technology).

c. That of those transferring to four-year schools from the Technical Program, approximately 35% remain to take additional course work at Westchester Community College. This course work is normally in the area of higher level mathematics as well as Inorganic Chemistry and Modern Physics.

d. Students continuing at Westchester Community College, do so to meet the requirement of four-year schools. This requirement forces many of the students to be "out-of-sequence", thus delaying their entry to a four year school by at least six months and in most instances one year.

e. "Out-of-sequence" is primarily caused by a deficiency in mathematics and not physics or chemistry.

f. All of the technical programs offered allow flexibility for students to take these higher level math courses. However, many students deciding to change their career goals and transfer to a four-year institution have become "out-of-sequence". Thus, the technical program does not totally satisfy the needs of students enrolled in their program.

g. Based upon past trends and the number of students enrolled in the technical programs, as well as future predictions and economic restraints, it is practically impossible to offer a dualized program within each of these disciplines to satisfy both the students interested in direct entry into the job market versus those desiring to transfer to a four-year school.

h. Those students enrolled in the technical curriculum and not transferring to four-year schools desire additional mathematics courses over that presently required.

i. Isolated differences exist within each program with respect to physics, chemistry and electives and are best treated on an individual basis.

j. To maximize the transfer potential the the engineering science program should investigate the:

(1) reduction of the physics requirement by one term.

(2) introduction of thermodynamics and electrical engineering into the program.

(3) introduction of a computer science option.

Based upon the above, it is evident that certain changes are required within each of the technical programs. These changes (to have maximum benefit) should occur within the common core. In addition, this common core should agree with the overall core requirement as currently being evaluated by the College. The following section indicates the suggested core modifications as well as the methods of implementing the recommended changes.

F-2. Problem Identified

Based on the survey results it is evident that the math requirements is the most critical and common to all programs. Each of the Technical programs require their students to take algebra-trigonometry or higher in the first semester with only Electrical requiring an additional mathematics (Precalculus or higher) in the second year. The sequence and level of these requirements invariably places the student "out-of-sequence" with respect to his change in goals thus affecting his transfer to four year colleges.

The obvious solution is to require all students to take algebra-trigonometry and Precalculus during the first year. This would give those students intending to transfer the opportunity to take Calculus I and Calculus II in the second year. However the faculty involved in the technical programs have resisted this in that it would require an additional four credit course in an already tight program and as such would necessitate the dropping of technical electives. In addition, the Technical programs have continually stressed the importance of physical application versus "pure math" (especially for their

non-transfer oriented students) in algebra-trigonometry and Precalculus.

The problem then is to develop a mathematics sequence that will:

1. Give technical students desiring to transfer the opportunity to complete Calculus II prior to graduation.
2. Give technical students not transferring a better background in mathematics with emphasis in practical application.
3. Develop academically sound sequences that will satisfy the faculties involved in mathematics and the technical programs, i.e., credits/course content.

F-3. Resolution of Problems

Of the three problems identified the first two can readily be resolved by the sequencing of courses so that students electing to transfer can take Calculus I and II during their second year by utilizing the options that currently exists. This assumes that the prerequisite (algebra & trigonometry and precalculus) be taken in the first year. The inclusion of these prerequisites would require modification of the existing Technical Programs.

However, the Technical Programs have a valid argument in that the two existing courses (while quite satisfactory from a pure math viewpoint) do not include substantial technical application of the theory presented and as such are not totally appropriate for their non-transfer oriented students. In addition they are concerned that any significant increase in the math requirements would result

in a corresponding decrease in technical electives taken. Thus, they conclude that adoption of the current mathematics sequence would have significant negative affect on their non-transfer students.

These concerns can be resolved by the development of two new mathematics courses which prepare students for the calculus sequence (Calculus I, etc.) and at the same time stress technical application of the theory covered. These new courses would be:

Technical Mathematics 1 - 3 credits

This course includes topics in review of basic algebra, parctical geometry with trigonometry functions and ratios and portions all included. Technical applications are discussed throughout the course.

Technical Mathematics 2 with Calculus - 3 credits

A continuation of the topics included in Technical Math 1 applied trigonometry, linear equations with more than one variable, functions with introduction to differential and integral calculus. Technical applications are stressed.

These new courses would be required of all technical students and would replace the existing sequence of algebra-trigonometry and precalculus.

It is also recommended that enrollments in these courses should be based on the preparedness of the student. If the student is found deficient, a suitable program of study should be recommended which

may include the existing sequence (algebra & trigonometry and pre-calculus). This will result in a total of 8 credit hours versus the then normal 6 credit hours.

These courses (algebra & trigonometry and precalculus) should be modified slightly to include more technical examples. This can be accomplished by offering special sections for the technology students.

With the inclusion of these two math courses, the following benefits are derived:

1. All students enrolled in the technical program will have a stronger mathematics background regardless of their choice of transfer versus occupation.
2. The problem in "sequencing" for those desiring transfer will be reduced in that these new courses would be taken during the first year.

   Thus, those students desiring transferring can take advantage of the current flexibility provided in each of the Technical programs for Calculus I and Calculus II during their second year.
3. The impact of these modifications on each of the technical programs will be minimal in that the math requirements will be increased (decrease in Electrical Technology) by only 2 credits (with a corresponding change in Technical electives). In fact, it will have a significant benefit in that all students will have a better mathematics background.

4. With adoption of this new core requirement each of the Technical Curricula will meet the requirements for ECPD Accreditation. Excerpts of the "ECPD Accreditation Requirements" are listed in Appendix "E".

F-4. Method of Implementation

In order to insure that the proposed recommendations are adopted and included in the program the following steps are suggested:

1. Copies of the study with the proposed recommendation are to be submitted to the faculty of each Technical Program for their review and comment. This review should also include recommendations as it effects the technical electives.
2. The Mathematics Department should be requested to develop the new math course, i.e., Technical Math I and Technical Math 2 with Calculus along the lines indicated.
3. Upon development of these two courses, a request for review by the Curriculum Committee of the College Senate should be made subsequent to discussion and recommendation by the entire Faculty Senate.
4. The Faculty Senate should then forward their recommendation to the President and the Board of Trustees for their approval, and if so approved, the modifications suggested should be implemented.
5. Upon implementation, a copy of each of the revised Technical Programs should be forwarded to the State University of New York and the State Education Department.

ENGINEERING SCIENCE (A.S.)
TYPICAL PROGRAM

First Year

First Semester (Fall)

		Credits
150111	Composition & Literature I or English I	3
170119	*Calculus I	4
190615	General Inorganic Chemistry I	4
190616	General Inorganic Chemistry I Lab	0
090211	Engineering Physics I (Mechanics)	4
090212	Engineering Physics I Lab	0
083511/083521	Physical Education	1
091011	Engineering Drawing I	2
	Total Credits	18

Second Semester (Spring)

150121	Composition & Literature II or English II	3
170129	Calculus II	4
190625	General Inorganic Chemistry II	4
190626	General Inorganic Chemistry II Lab	0
091922	Engineering Physics II (Heat, Light & Sound)	4
091923	Engineering Physics II Lab	0
083514/083524	Physical Education	1
070461	Computational Devices	1
	Total Credits	17

*Precalculus is a prerequisite for Calculus. Students with less math preparation must consult with the Engineering Science Chairman for the proper math sequence and should expect to take more than four semesters to complete their course of study. Also note that, in general, Engineering Physics I must be taken with Calculus I.

Second Year

First Semester (Fall)

		Credits
170139	Calculus III	4
091933	Engineering Physics III (Electricity & Magnetism)	4
091934	Engineering Physics III Lab	0
091032	*Statics	3
070431	Computer Programming, Fortran IV	3
	Social Science Elective	
	Total Credits	17

Second Semester (Spring)

170149	Differential Equations	4
091945	Engineering Physics IV (Modern Physics)	4
091946	Engineering Physics IV Lab	0
	*Dynamics	3
	Social Science Elective	3
	**Engineering Elective	4-5
	Total Credits	18-19

*Chemical Engineering students take Quantitative Analysis, Chemical Engineering Operations, and Organic Chemistry, instead of Statistics and Dynamics and engineering elective.

**Mechanical and Civil Engineering students elect Strength of Materials and Materials Testing Lab. Electrical Engineering students elect Passive and Active Networks and AC Circuits Lab

CIVIL TECHNOLOGY (A.A.S.)
LOGICAL SEQUENCE OF PROGRAM

First Year

First Semester (Fall)

		Credits
150111	Composition & Literature I or English I	3
	Social Science Elective	3
170117	*Algebra & Trigonometry (or more advanced math)	4
190211	*Tech Physics I (Mechanics)	4
190212	*Tech Physics I Lab	0
091011	Engineering Drawing I	2
530011	Engineering Laboratory	1
083511/083514	Physical Education	1
	Total Credits	18

*Students not meeting the Mathematics requirement of 170117 should register for Basic Concepts of Mathematics. Physics cannot be taken until 170117 is taken.

Second Semester (Spring)

150121	Composition & Literature II or English II	3
	Social Science Elective	3
190223	Tech Physics II (Heat, Light & Sound)	4
190224	Tech Physics II Lab	0
530913	Architectural Drawing I	2
530921	Construction Methods and Materials	3
083521/083524	Physical Education	1
530922	Construction Laboratory	1
	Total Credits	17

Second Year

First Semester (Fall)

		Credits
090830	Elements of Strength of Materials	3
090831	Structural Design I	2
090833	Surveying I	3
530932	**Environmental Problems & Controls	3
530933	**Environmental Lab	1
530931	Construction Estimating	3
530934	Materials Properties	3
	Total Credits	18

Second Semester (Spring)

530943	Architectural Design	2
090841	Structural Design II	2
090843	Surveying II	3
090840	Highway Design	2
530941	**Construction Management & CPM	3
530942	Contracts & Specifications	3
090844	Materials Testing Laboratory	1
	Total Credits	16

**Students meeting the requirements for advanced mathematics and electing the mathematics option may substitute courses from the Calculus sequence for these technical courses.

NOTE: Students taking the higher mathematics sequence can take Physical Education in the second semester of the second year.

ELECTRICAL TECHNOLOGY (A.A.S.)
LOGICAL SEQUENCE OF PROGRAM

First Year

		Credits
	First Semester (Fall)	
150111	Composition & Literature I or English I	3
170117	*Algebra & Trigonometry (or more advanced math)	4
190211	Tech Physics I (Mechanics)	4
190212	Tech Physics I Lab	0
091011	Engineering Drawing I	2
530011	Engineering Laboratory	1
090911	Introductory DC Circuits	3
090912	Introductory DC Circuits Lab	1
	Total Credits	18

*Students not meeting the mathematics requirements of 170117 should register for Basic Concepts of Math. Physics cannot be taken until 170117 is taken.

	Second Semester (Spring)	
150151	Composition & Literature II or English II	3
170321	Engineering Mathematics - Precalculus	4
190223	Tech Physics II (Heat, Light & Sound)	4
190224	Tech Physics II Lab	0
083521/083522	Physical Education	1
090921	Intro AC Circuits Analysis	4
090922	Intro AC Circuits Lab	1
	Total Credits	17

Second Year

	First Semester (Fall)	
090931/090932	Electrical Machinery & Feedback Systems & Lab	4
090933/090934	Semiconductor & Vacuum Tube Electronics & Lab	4
090935/090936	Electronic & Frequency Sensitive Circuits & Lab	4
	Social Science Elective	3
	**Elective (Technical or Mathematical)	3
	Total Credits	18

	Second Semester (Spring)	
090941/090942	Energy Conversion & Control and Lab	4
090943/090944	Solid State & Vacuum Tube Devices and Lab	4
090945/090946	Microwave & Communication Theories and Lab	4
	Social Science Elective	3
083521/083524	Physical Education	1
	Total Credits	16

**Students who meet the requirement for higher mathematics may select an additional mathematics course or substitute a technical elective such as advanced electrical courses 090947, 090937, 090951, 090952, 090955, or 090956 with approval of the department chairperson. Students who have already completed six credit hours within the social science area prior to the second year may choose a mathematics elective or technical elective such as courses 090947 or 090937. Other electives are 090938, 090948, 090953 and 090954 in addition to the courses previously mentioned. Note: Six credits of Social Science are required for graduation.

MECHANICAL TECHNOLOGY (A.A.S.)
LOGICAL SEQUENCE OF PROGRAM

First Year

First Semester (Fall)

		Credits
190211	*Tech Physics I	4
109212	*Tech Physics I Lab	0
150111	*English I or Composition & Literature I	3
170117	*Algebra & Trigonometry	4
091011	*Engineering Drawing I	2
091022	*Mechanical Laboratory	2
083511/083514	*Physical Education	1
	Total Credits	16

Second Semester (Spring)

190223	*Tech Physics II	4
190224	*Tech Physics II Lab	0
150121	*English II or Composition & Literature II	3
	*Social Science	3
091023	*Manufacturing Processes	3
091021	*Engineering Drawing II	2
091024/	*Mechanics I or Statics	3
	Total Credits	18

Second Year

First Semester (Fall)

		Credits
090844	*Materials Testing Lab	1
090939	*Electric Motors & Controls	3
090940	*Electric Motors & Controls Lab	1
091035/	*Mechanics II or Strength of Materials	3
	*Fund. of Heat Power/Hydraulics	5
	*Fund. of Heat Power/Hydraulics Lab	0
	Total Credits	13

Second Semester (Spring)

	*Social Science	3
091030	*Mechanisms	2
091031	*Mechanisms Lab	0
091036/	*Mechanics III or Dynamics	3
083521/083524	*Physical Education	1
	Total Credits	9

Typical Technical Electives

Tool Fixture Gauge Design & Lab	2	Fund. Ht/Pwr Hyd II & lab	5
Surveying I	3	Machine Design & Lab	2
Computer/N.C. Programming	2	Production Planning & Lab	4
Gen. Inorganic Chem. I & Lab	4	Gen. Inorganic Chem. II & Lab	4
**Other	3-4	**Other	3-4
	17		17

*Required courses; 68 credits needed for graduation
**Other electives may be substituted by prior approval, in writing, by Department Chairman.
NOTE: Following are offered both semesters:
Calculus sequence, 4 credits each; Computer Programming Fortran (3 cr.)

Special program options may be arranged for students interested in Civil, Electrical or Business.

WESTCHESTER COMMUNITY COLLEGE
VALHALLA, NEW YORK

Current Student Survey

NOTE: If more than one choice is applicable, please so indicate.

1. Why did you choose Westchester Community College?

   a) programs offered _____

   b) local college _____

   c) financial consideration _____

   d) other (please specify) _____

2. What curriculum or department were you enrolled in at Westchester Community College? _____

3. What was the highest math course taken at Westchester Community College as part of your degree program?

   a) Algebra & Trigonometry _____

   b) Precalculus _____

   c) Calculus I _____

   d) Other (Please specify) _____

4. Do you intend to take any other math courses at Westchester Community College after completion of degree requirements?

   a) Yes _____ Please specify _____

   b) No _____

5. Do you plan to transfer to a four-year institution?

   a) Yes _____

   b) No _____

6. If so, what institution? _____

   What degree program? _____

   Full time _____ Part time _____

WESTCHESTER COMMUNITY COLLEGE
VALHALLA, NEW YORK

Post Graduate Survey

NOTE: If more than one choice is applicable, please so indicate:

1. Why did you attend Westchester Community College?

   a) programs offered _____ c) Financial consideration _____

   b) local college _____ d) Other (please specify) _____

2. When did you graduate from Westchester Community College? _____

3. What curriculum or department were you enrolled in at Westchester Community College? _____

4. What was the highest math course taken at Westchester Community College as part of your degree program?

   a) Algebra & Trigonometry _____

   b) Precalculus _____

   c) Calculus I _____

   d) Other (please specify) _____

5. Did you take any other math courses at Westchester Community College after completion of degree requirements?

   a) Yes _____ (Please specify) _____

   b) No _____

6. Did you transfer to a four-year institution?

   a) Yes _____ b) No _____

7. If so, what institution? _____

   What degree program? _____

   Full time _____ Part time _____

8. How many credits were required for graduation? _____

9. When did/will you graduate? _____

10. Are you employed: a) area of study _____

    b) related field _____

    c) other _____

WESTCHESTER COMMUNITY COLLEGE
75 Grasslands Road
Valhalla, New York

TRANSFER SURVEY

Directions: Please answer each question in the space provided. More than one answer is appropriate. Please indicate in order of preference.

1. Does your institution accept Associate Degree transfers from community colleges?

   a. Yes _____ b. No _____

   If yes, approximately how many credits do you accept from their Associate Degree?

   0-15 _____ 15-30 _____ 30-45 _____ 45+ _____

2. If so, from which program do you accept transfer students?

   a. Civil Technology _____

   b. Electrical Technology _____

   c. Mechanical Technology _____

   d. Engineering Science _____

   e. Chemical Technology _____

3. How many graduates of Westchester Community College are enrolled at your institution?

   Currently _____ Last 5 years _____

4. How many graduates of Westchester Community College have successfully completed the degre requirements at your institution during the past 5 years? _____

5. How do you find the Westchester Community College graduates' preparedness in Mathematics?

   a. Excellent _____

   b. Good _____

   c. Average _____

   d. Below Average _____

Post Graduate Survey

Respondent #	Question #: 1	2	3	4	5	6	7	8	9	10
1	a	6/74	Electrical Technology	a	a-Calc I	a	Manhattan BEE, FT	64/60	1/77	a
2	a	6/77	Mechanical Technology	c	b	b	——	——	——	b
3	b,c	12/76	Electrical Technology	a	a-Calc III	b	——	——	——	a
4	a,c	77	Engineering Science	d-Diff. Eq.	b	a	SUNY, Maritime, EE, FT	166/48	1980	no
5	——	73	Civil Technology	c	b	a	Manhattan CT, FT	128/64	——	b
6	c	5/76	Eng. Draft. Cartificate	a	b	b	——	——	——	a
7	a,b,c	75	Civil Technology	d-Calc. II	a-Calc. III & IV	a	Manhattan CT, PT	66/-	——	a
8	b,c	77	Chemical Technology	d-Calc. II	b	a	Manhattan Chem Eng, FT	130/66	1980	c
9	a	75	Electrical Technology	c	a-Calc. I	b	——	——	——	b
10	b	73	Civil Technology	c	b	a	Fairleigh Dickinson CT, FT	130/All	1975	b
11	b,c	73	Electrical Technology	c-Calc. I	b	a	B.E.T. BSEE, PT	143/71	1978	b
12	a	77	Civil Engineering	b	b	b	——	——	——	c
13	b,c	75	Electrical Technology	b	a-Calc. II	a	U.Bridgeport BioMed Eng FT	131/58	5/78	a
14	b,c	——	Engineering Science	d-Diff. Eq.	b	a	Manhattan Chem Eng, FT	132/66	1980	——
15	a,b,c	12/77	Civil Technology	b	b	b	——	——	——	b
16	b,c	77	Engineering Science	d-Diff. Eq.	a-Alg & Trig Ma Finance	a	U. Buffalo C Eng, FT	—/64	5/79	a
17	a	76	Chemical Technology	c	b	b	——	——	——	a
18	a,b,c	——	Electrical Technology	——	b	b	——	——	——	——

Appendix E

Respondent #	Question #: 1	2	3	4	5	6	7	8	9	10
19	b	——	Bus. Marketing	a	b	b	——	——	——	c
20	a,b,c	75	Electrical Technology	c	b	b	——	——	——	b
21	a,b,c	5/74	Engineering Design	d-Statistics	b	b	——	——	——	b
22	a,b,c	78	Mechanical Technology	c	a-Calc. II	a	Manhattan M Eng, FT	-/66	1980	b
23	a,b	76	Electrical Technology	a	a-Finite Ma Calculus	a	Pratt Inst. Data Sys. Mgmt., FT	135/60	1/79	no
24	a,b,c	——	Electrical Technology	——	b	a	Bridgeport Eng. Inst. BSEE, Pt	143/60	1979	a
25	a,b,c	77	Civil, Eng Draft Cert	a	b	b	——	——	——	a
26	a,b,c	6/76	Civil Technology	a	b	a	CUNY, Arch Draft, PT	48/-	1/79	a
27	c,d-Uncertain major	6/78	Engineering Science	d-Diff. Eq.	b	a	U. Vermont Elec.E, FT	126/70	1981	b
28	a,b,c,d-unsure goals	6/76	Civil Technology	d-Calc. 2	b	a	RIT, Man. BCT,BCE,FT	132/66	1979	——
29	a	77	Engineering Science	d-Diff. Eq.	b	a	Cornell U. EE, FT	128/64	6/79	——
30	a,c	6/78	Engineering Science	d-Diff. Eq.	b	a	SUNY Stony Brook,ME,FT	120/-	81-82	no
31	b,c	76	Electrical Technology	a	a-Precalc.	a	SUC Buffalo Ind Tec, FT	123/45	1978	b
32	b	77	Engineering Science =	d-Diff. Eq.	b	a	Manhattan EE, PT	84/35-	1980	a
33	a,b,c	71/73	Civil Tech Eng. Sci.	d-Diff. Eq.	b	a	Columbia U. CE, FT	-/64	75 BSCE 78 MSCE	a
34	a,b,c	5/77	Engineering Science	d-Diff. Eq.	b	a	U.Bridgeport ME, FT	120/64	——	c
35	a,b,c	73	Civil Technology	b	——	b	——	——	——	b
36	b	77	Eng Draft Certificate	d-Bas. Con.	b	b	——	——	——	c
37	a,b,c	5/78	Electrical Technology	b	b	a	Fairleigh Dickinson ET, FT	128/64	1980	c

Respondent #	Question #: 1	2	3	4	5	6	7	8	9	10
38	b,c	76	Civil Technology	d-Calc. II	a-Calc. II	a	Manhattan CE, FT	70/66	1978	b
39	b,c	75	Civil Technology	d-Calc. III	a-Diff. Eq.	a	Manhattan CE, FT	183,66	1978	a
40	a,c	6/77	Civil Technology	d-	b	a	Manhattan CE, FT	136/60	6/79	c
41	a,b	75	Electrical Technology	a	a	b	———	———	———	b
42	a,c	75	Civil Technology	d-Calc. II	b	a	NY Inst Tech Arch, FT	168/All	1978	a
43	c	74	Mechanical Technology	d-Diff. Eq.	b	a	Manhattan ME, FT	132/57	1976	b
44	b,c	73	Electrical Technology	c	a-Calc. II	a	U.Bridgeport EE, FT	70/50	1978	c
45	a,b	6/78	Civil Technology	d-Calc. III	b	a	Manhattan FT	75/75	1980	—
46	a,c	73	Civil Technology	c	b	a	Manhattan ME, FT	135/67	———	a
47	b	76	Civil Technology	b	a-Calc. I,II III, Diff Eq	a	Manhattan CT, PT	———	———	b
48	a,b	6/74	Civil Technology	b	a-Calc, I,II	a	Manhattan Civil Trans. PT	———	———	a
49	a,b,c,d-good job place.	6/76	Electrical Technology	d-Calc. II	a-Calc. III	b	———	———	———	a
50	a	76	Civil Technology	c	a-Calc. III, Diff. Eq.	a	Manhattan CE, PT	132/58	1981	b
51	a,b,c	77	Civil Technology	c	b	a	Iona, Const & Fac Mgmt FT	89/36	1979	c
52	a,b	77	Civil Technology	c	b	b	———	———	———	b
53	b,d-Uncer-tain goals	75	Civil Technology	c	b	a	Manhattan CE, FT	136/66	1/78	a
54	a	6/78	Electrical Technology	c	b	b	———	———	———	a
55	a,c	75	Chemical Technology	d-Calc. III	a-Calc II, & III	a	CCNY, Chem Eng, FT	150/44	———	a
56	a,b,c	74	Electronics	c	b	b	———	———	———	b

Appendix E

Respondent #	Question #: 1	2	3	4	5	6	7	8	9	10
57	c	5/75	Electrical Technology	b	b	a	Fairleigh D. EE	128/64	5/77	a
58	b	6/73	Electrical Technology	d-Calc. II	a-Calc. II	b	——	——	——	b
59	a,b	6/78	Electrical Technology	c	a-Calc. I	b	——	——	——	a
60	a,b,c	6/76	Electrical Technology	d-Calc. III	b	a	U.Bridgeport EE, FT	130/65	5/78	b
61	a,b,c	8/78	Electrical Technology	d-Calc. II	b	b	——	——	——	a
62	a,b,c	73	Engineering Science	d-Diff. Eq.	b	a	Manhattan CE, FT	128/64	1976	—
63	a,d-Uncertain goals	-78	Engineering Science	d-Diff. Eq.	b	a	RIT, EE FT	-/All	1981	—
64	b,c	75	Electrical Technology	a	b	b	——	——	——	c
65	b,c	74	Civil Technology	b	b	a	Manhattan CE, PT	86/66	——	a
66	b,c	74	Civil Technology	c	a-Calc. II	b	——	——	——	a
67	a,b,c,d-small scl.	8/78	Engineering Science	d-Diff. Eq.	a-Statistics	a	SUNY Stony Brook,EE,FT	128/All	6/80	no
68	b,c	76	Civil Technology	b	a-Calc I,II	a	Manhattan CE, FT	--/72	1980	a
69	a,b	5/78	Civil Technology	c	b	b	——	——	——	a
70	b,c	——	Electrical Technology	a	b	b	——	——	——	a
71	a,b,c,d-2 yr school	75	Chemical Technology	a	a-Calc. I	a	Pace, Biol. PT	120/50	1980	a
72	b,c	73	Engineering Science	d-Diff. Eq.	b	a	Manhattan ME, FT	144/72	1975	a
73	b,c	6/75	Electrical Technology	d-Calc. III	b	a	Manhattan EE, FT	--/70	6/77	a
74	b	6/77	Engineering Science	d-Diff. Eq.	b	a	Manhattan EE, FT	—/64	6/79	—
75	a	76	Civil Technology	—	b	a	Utica, Const Mgmt, FT	128/40	1977	b
76	a,b,c	77	Electrical Technology	c	b	b	——	——	——	a

Respondent #	Question #: 1	2	3	4	5	6	7	8	9	10
77	c,d	6/73	Engineering Science	d-Calc. IV	b	a	U. Rhode Island, CE, FT	128/48	6/76	a
78	a,d-rural lifestyle	6/74	Electrical Technology	d-Calc. II	b	a	Manhattan EE, FT	132/64	1976	a
79	d-Uncertain of goals	5/78	Engineering Science	d-Diff. Eq.	b	a	Steven Inst of T, ME, FT	154/55	5/80	—
80	a	75	Mechanical Technology	d-Diff. Eq.	a	a	Northeast. U BSME, FT	178/90	6/79	no
81	b	6/78	Electrical Technology	c	b	a	U. Bridgeport Comp. Eng, PT	-----	—	a
82	a,b,d-location	6/78	Civil Technology	b	a-Precalc.	a	Manhattan CE, FT	—/65	—	a
83	a,b	6/75	Engineering Science	d-Diff. Eq.	b	a	Bridgeport Eng Ins, ME, P	142/70	1978	b
84	b	76	Civil Technology	c	a-Calc. II	a	Manhattan CE, FT	—/62	1980	c
85	a,b,c	73	Eng Draft, Civil Tech	b	b	b	-----	-----	—	b
86	b,c	76	Engineering Science	d-Diff. Eq.	b	a	Manhattan BEME, FT	—/65	1978	a
87	c	77	Mechanical Technology	c	b	a	Manhattan ME, FT	75/70	1979	—
88	b	12/73	Civil Technology	a	a-Calc I,3,4	a	Manhattan CE, FT	-----	5/78	a
89	a,b,c,d-2 yr school	78	Chemical Technology	c	b	a	Marymount Chem, FT	—/64	5/79	c
90	a,b,c	5/77	Engineering Science	d-Diff. Eq.	a-Linear Alg	a	Columbia U ME, FT	--/64	5/79	c
91	b,c	77	Civil Technology	a	a-Precalc. Calc I,II	a	Manhattan CE, FT	120/64	1980	c
92	a,b	73	Mechanical Technology	c	b	a	Manhattan BEME, FT	138/66	1976	b
93	a,b,c	75	Electrical Technology	b	a-Calc I, Stat.	a	West Conn St BBA, PT	72/40	—	a
94	c	78	Engineering Science	d-Diff. Eq.	b	a	Clarkson Chem Eng, FT	—/60	1980	—

Respondent #	Question #: 1	2	3	4	5	6	7	8	9	10
95	a,b,c	74	Civil Technology	d-Calc. II	b	a	Manhattan CE, FT	120/66	1/77	yes
96	a	6/78	Civil Technology	d-Calc. II	a-Calc. II	a	Manhattan CE, FT	126/60	1980	no
97	b	5/75	Civil Technology	d-Diff. Eq.	b	a	Manhattan CE, FT	132/66	5/77	no
98	a,b,c	78	Engineering Science	d-Diff. Eq.	b	d	Bridgeport Eng Inst.	--/72	1981	a
99	a,b	6/77	Civil Technology	a	a-Calc I	a	Manhattan CE	132/66	---	a,b
100	a,b,c	6/75	Civil Technology	a	b	a	U-Mass. Wood Sci.	120/49	6/80	a

Current Student Survey - Electrical Technology

Respondent #	Question #: 1	3	4	5	6
1	a,b,c	c	b	a	City Coll, Eng, PT
2	a,b,c	b	a-Calculus I	b	
3	c	c	a-Calculus III	a	Undec., BEE, FT
4	a,c,d-open enrollment	d-Calculus II	a-Diff. Eq.	a	Undec., EE, FT
5	a,b,c	b	a-Calculus II	a	Undec., EE, FT
6	c	b	b	a	Pace, Bus Adm, FT
7	a,b	c	b	b	
8	a,c	b	a-Calc I, II, III	a	Bridgeport, EE, PT
9	a,b	c	b	a	Undec., EE, PT
10	c	d-Calculus II	a-Calc III, IV	a	Stony Brook, EE, FT
11	b,c	c	b	b	
12	a,b,c	b	a-Calculus II	b	
13	a,c	c	a	a	Undec., EE, PT
14	a,b,d-loc.	b	b	a	Binghamton, R Tech, FT
15	a,c	b	b	b	
16	c	b	a-	a	Fair. Dick., EE, FT
17	a,c	b	b	b	
18	b	a	a-Calc II, III, DE	a	Undec., EE, PT
19	a,c	b	b	b	
20	a,b,c	b	b	b	
21	a,b,c	b	b	a	Fla. Int. U., EE, FT
22	c	b	b	b	
23	a,b,c	b	b	b	
24	a,b,c	a	a-Calculus	b	
25	a,b,c	d-Calculus II	b	b	
26	a,b	c	b	b	
27	b,c	c	a-Calc II, III, DE	a	Manhattan, EE, FT
28	b,c	b	a-Calculus I	a	Manhattan, EE, PT
29	a,c	b	b	a	Fair. Dick, EE, FT
30	a,b	a	b	b	
31	a,c	c	a-Calculus II	a	Undec., EE, PT
32	a,c	d-Calculus III	a-Diff. Eq.	a	Manhattan, Math
33	a	a	a-Precalculus	b	

Current Student Survey

Electrical Technology

Respondent #	Question #: 1	3	4	5	6
34	a,b	b	a-Calc III, DE	a	Undec., EE, FT
35	a,b	c	b	a	Bridgeport, PT
36	a,b	a	a-Precalculus	a	Undec., FT
37	c	a	a-Precalculus	a	Manhattan, Undec., FT
38	a	d-none	b	a	Undec., ET, PT
39	a,b	c	b	b	
40	a	a	b	a	NY Tech, FT
41	a,b	d-Calc II	a-	a	Undec., FT
42	b	b	a-Calculus I	a	Undec., Eng, FT
43	a,b,c	b	b	b	
44	b,c	b	a-Calculus	a	Undec., PT
45	a,c	b	b	a	Undec., EE, PT
46	b	b	b	b	
47	b	b	a-Diff. Eq.	a	Undec., FT
48	b,c	c	b	b	

Current Student Survey - Civil Technology

Respondent #	Question #: 1	3	4	5	6
1	c	b	b	a	Buffalo, FT
2	c	b	a-Calculus	a	----, CT, FT
3	a	c	b	a	So Colorado, FT
4	b	d - Diff. Eq.	b	a	Manhattan, CE, FT
5	a	a	a-Calculus	a	Manhattan, CT, PT
6	a,b,c	b	a	?	
7	a,b	b	a-Calculus I, II	a	SUNY, CE, FT
8	b,c	d - Calculus II	a-Calc III, D.E.	a	Cornell, Eng, FT
9	b,c	d - Calculus II	b	a	Manhattan, CE, FT
10	a,b,c	d - Calculus II	b	a	Arizona St, Civil, FT
11	b	d - Calculus II	a-Calculus III	a	Manhattan, FT
12	b	b	a-Calculus I	?	
13	a,c	a	b	a	ColoradoT,SolarEng, PT
14	c	d - Calculus II	a	a	Undecided, CE, FT
15	a	b	a-Calculus I	a	Undecided
16	a,b,c	c	a	a	Manhattan, CE
17	a	c	a-Calc, D.E.	a	Undecided, CE, PT
18	b,c	c	a-thru D.E.	a	Manhattan, CE, FT
19	a,b	a	a-Precalculus	b	
20	b,c	b	a-Calc thru D.E.	a	Manhattan, Eng, FT
21	a,b,c	b	a	a	Undecided, CE/Arch,FT
22	c	d - Calculus II	b	a	Buffalo, Civil, FT
23	c	c	b	a	NYIT, Arch, FT
24	a,c	d - Diff. Eq.	b	a	Manhattan, BS, FT
25	a	a	a-Diff. Eq.	a	Undecided, Eng, FT

Current Student Survey - Mechanical Technology

Respondent #	Question #: 1	3	4	5	6
1	c	a	b	a	Undecided, Eng, FT
2	a	a	a-Precalc., Calc. I	a	Undecided, PT
3	b,c	c	b	b	
4	b,c	c	a-Calculus II	a	Manhattan, ME, FT
5	b	c	a-Calculus II	a	Undecided, MT, FT
6	a,b	a	b	b	
7	a,b,c	d - Calculus II	b	a	Pratt/MiamiU, MT, FT
8	a,b	b	b	a	----, BS, PT
9	b,c	a	b	b	

Current Student Survey - Engineering Science

Respondent #	Question #: 1	3	4	5	6
1	a,b	d - Diff. Eq.	b	a	Columbia, ME, FT
2	b	d - Calculus II	b	a	Miami U, Eng, FT
3	a,c	d - Diff. Eq.	b	a	Manhattan, Eng, FT
4	b	c	b	a	Oklahoma U, ME, FT
5	a,b,c	d - Diff. Eq.	b	a	----, ME, FT
6	a,b,c	d - Calculus III	b	a	RPI/Stevens, CompSci,FT
7	c	d - Diff. Eq.	b	a	RIT/Stony Br,CompEng,FT
8	c	d - Diff. Eq.	b	a	Manhattan,BE, FT
9	d-low grades	d - Diff. Eq.	b	a	Bridgeport/Hofstra, Eng Sci/Elec, FT
10	a,b	d - Diff. Eq.	b	a	Cornell/RPI, BS, FT
11	c	d - Diff. Eq.	b	a	Stony Brook, EE,, FT
12	a	d - Diff. Eq.	b	a	RIT, EE, FT
13	b,c	d - Diff. Eq.	b	a	Sacramento St, CompSci, FT
14	b	d - Diff. Eq.	b	a	Stony Brook, EE, FT
15	c	d - Diff. Eq.	b	a	Manhattan, EE, FT
16	b,c	d - Diff. Eq.	a - Statistics	a	Manhattan, EE, FT
17	b,c	d - Diff. Eq.	b	a	SUNY, ME, FT
18	b,c	d - Calculus III	b	a	RPI/Stevens,CompSci,FT